

This listing of claims will replace all prior versions,
and listings, of claims in the application:

1 Claim 1 (original): A method comprising:
2 a) accepting a packet associated with a flow;
3 b) generating a flow group identifier from the flow;
4 c) determining whether any other packets associated with the
5 flow group are present in a switch fabric;
6 d) if it is determined that other packets associated with
7 the flow group are present in the switch fabric, then
8 assigning the packet to a path being used by the flow group,
9 and if it is determined that other packets associated with
10 the flow group are not present in the switch fabric, then
11 assigning the packet to a path using path congestion status
12 information.

1 Claim 2 (original): The method of claim 1 wherein the act of
2 generating a flow group identifier from the flow includes hashing
3 a flow identifier.

1 Claim 3 (original): The method of claim 1 wherein the act of
2 determining whether any other packets associated with the flow
3 group are present in a switch fabric includes maintaining an
4 outstanding packet counter.

1 Claim 4 (original): The method of claim 3 wherein the outstanding
2 packet counter is associated with the flow group identifier.

1 Claim 5 (original): The method of claim 4 wherein the act of
2 maintaining an outstanding packet counter includes incrementing
3 the outstanding packet counter each time a packet belonging to the
4 flow group is sent into the switch fabric, and decrementing the

5 outstanding packet counter each time a packet belonging to the
6 flow group leaves the switch fabric.

1 Claim 6 (original): The method of claim 5 wherein the act of
2 decrementing the outstanding packet counter is performed in
3 response to a message from an output port.

1 Claim 7 (original): The method of claim 6 further comprising:
2 - passing the message from the output port to a
3 corresponding input element,
4 - passing the message from the corresponding input element,
5 through the switch fabric, to another output element, and
6 - passing the message from the other output element to
7 another input element corresponding to the other output
8 element, wherein the other input element originated the
9 packet.

1 Claim 8 (original): The method of claim 3 wherein the act of
2 maintaining the outstanding packet counter includes resetting the
3 outstanding packet counter if it remains non-zero for more than a
4 predetermined period of time.

1 Claim 9 (original): The method of claim 1 wherein the act of
2 assigning the packet to a path using path congestion status
3 information includes
4 - selecting a switch plane having at least one uncongested
5 path, and
6 - selecting an uncongested path of the selected switch
7 plane.

1 Claim 10 (original): The method of claim 9 wherein the act of
2 selecting a switch plane having at least one uncongested path uses
3 a round robin discipline.

1 Claim 11 (original): The method of claim 9 wherein the act of
2 selecting an uncongested path of the selected switch plane uses a
3 round robin discipline.

1 Claim 12 (original): A machine-readable medium having stored
2 thereon a data structure comprising a plurality of entries, each
3 entry including
4 a) a flow group identifier,
5 b) an outstanding packet in switch fabric indicator, and
6 c) a path identifier.

1 Claim 13 (original): The machine-readable medium of claim 12
2 further including a second data structure comprising a plurality
3 of entries, each entry including
4 a) the path identifier, and
5 b) path status information.

1 Claim 14 (original): The machine-readable medium of claim 13
2 wherein the path status information includes
3 i) an indicator of whether or not the path has failed,
4 and
5 ii) an indicator of whether or not the path is
6 congested.

1 Claim 15 (original): Apparatus comprising:
2 a) an input for accepting a packet associated with a flow;

3 b) means for generating a flow group identifier from the
4 flow;
5 c) means for determining whether any other packets
6 associated with the flow group are present in a switch
7 fabric;
8 d) means for assigning the packet to a path being used by
9 the flow group if it is determined that other packets
10 associated with the flow group are present in the switch
11 fabric, and for assigning the packet to a path using path
12 congestion status information if it is determined that other
13 packets associated with the flow group are not present in the
14 switch fabric.

1 Claim 16 (original): The apparatus of claim 15 wherein the means
2 for generating a flow group identifier from the flow hash a flow
3 identifier.

1 Claim 17 (original): The apparatus of claim 15 wherein the means
2 for determining whether any other packets associated with the flow
3 group are present in a switch fabric maintain an outstanding
4 packet counter.

1 Claim 18 (original): The apparatus of claim 17 wherein the
2 outstanding packet counter is associated with the flow group
3 identifier.

1 Claim 19 (original): The apparatus of claim 18 wherein the means
2 for maintaining an outstanding packet counter increment the
3 outstanding packet counter each time a packet belonging to the
4 flow group is sent into the switch fabric, and decrement the
5 outstanding packet counter each time a packet belonging to the
6 flow group leaves the switch fabric.

1 Claim 20 (original): The apparatus of claim 19 wherein the
2 decrementing of the outstanding packet counter is performed in
3 response to a message from an output port.

1 Claim 21 (original): The apparatus of claim 20 further
2 comprising:

- 3 - means for passing the message from the output port to a
- 4 corresponding input element,
- 5 - means for passing the message from the corresponding input
- 6 element, through the switch fabric, to another output
- 7 element, and
- 8 - means for passing the message from the other output
- 9 element to another input element corresponding to the other
- 10 output element, wherein the other input element originated
- 11 the packet.

1 Claim 22 (original): The apparatus of claim 17 wherein the means
2 for maintaining the outstanding packet counter reset the
3 outstanding packet counter if it remains non-zero for more than a
4 predetermined period of time.

1 Claim 23 (original): The apparatus of claim 15 wherein the means
2 for assigning the packet to a path using path congestion status
3 information include means for

- 4 - selecting a switch plane having at least one uncongested
- 5 path, and
- 6 - selecting an uncongested path of the selected switch
- 7 plane.

1 Claim 24 (original): The apparatus of claim 23 wherein the means
2 for selecting a switch plane having at least one uncongested path
3 use a round robin discipline.

1 Claim 25 (original): The apparatus of claim 24 wherein the means
2 for selecting an uncongested path of the selected switch plane use
3 a round robin discipline.

1 Claim 26 (original): A method for alleviating head-of-line
2 blocking in an input-buffered switch, wherein the switch includes
3 a plurality of input modules, each input module including virtual
4 output queues and virtual path queues, the method comprising:
5 a) assigning an incoming cell to an appropriate one of the
6 virtual output queues using cell destination information;
7 b) providing a head-of-line cell of the one of the virtual
8 output queues to an appropriate one of the virtual path
9 queues using path identifier information of the cell;
10 c) for an input module-to-switch plane link, selecting one
11 of a number of virtual path queues associated with the link
12 and having at least one cell; and
13 d) sending the cell from the selected one of the number of
14 virtual path queues over the link.

1 Claim 27 (original): The method of claim 26 wherein the path
2 identifier information of the cell was provided using a dynamic
3 hashing scheme.

1 Claim 28 (original): The method of claim 26 further comprising:
2 e) determining whether or not the cell sent over the link
3 was the last cell of a packet; and
4 f) if it was determined that the cell sent over the link was
5 the last cell of a packet, then instructing the virtual

6 output queue to send cells of a next packet to an appropriate
7 one of the virtual path queues.

1 Claim 29 (original): For use in a switch, an input module
2 comprising:
3 a) a plurality of virtual output queues for accepting cells;
4 and
5 b) a plurality of virtual path queues for accepting
6 head-of-line cells from the plurality of virtual output
7 queues.

1 Claim 30 (original): The input module of claim 29 wherein the
2 number of the plurality of virtual output queues equals a number
3 of output ports of the switch.

1 Claim 31 (original): The input module of claim 29 wherein the
2 number of the plurality of virtual path queues equals a number of
3 paths through a switch fabric of the switch.

1 Claim 32 (original): The input module of claim 29 wherein the
2 number of the plurality of virtual path queues equals a product of
3 (a) a number of switch planes of a switch fabric of the switch and
4 (b) a number of paths through each of the switch planes.

Amendments to the Drawings:

The attached sheet of drawings includes new
Fig. 13.

Attachment: Replacement Sheet